DOCUMENT RESUME

ED 051 071 SO 001 490

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TITLE The Demonology of Pollution.
PUB DATE 3 Apr 70
NOTE 16p.; Speech presented at the Environmental Teach-In, Pittsburgh, Pennsylvania, April 3, 1970

EDRS PRICE EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS *Economic Factors, *Environmental Education, *Government Role, Industrialization, Overpopulation, *Pollution, Population Growth, *Social Factors, Social Problems, Social Structure, Social Systems, Speeches, Technology
IDENTIFIERS Corporatism, *Ecosystems

ABSTRACT

This paper offers a fresh perspective on causes of and solutions to environmental problems, and would be useful as an initiator of classroom discussions. The author argues that in our pursuit of a society based on environmentally sound principles, we have perhaps misidentified the villains, and have latched into solutions that may be either naive, or narrow. One commonly identified villain, for example, is population growth. While there is no doubt that more people put a greater burden on natural resources and human amenities, and that population growth should be controlled, this factor is not so important as high per capita consumption based on high per capita income. Other more complex examples, such as corporations, technology, and our socioeconomic systems, are similarly examined in terms of their contribution to the environmental crisis. The author concludes that an intelligent use of regulation and incentive penalty systems which take into account the complex interrelationships in modern industrialized society, will go a long way toward solving the problems, while leaving the most individual freedom intact. (JLB)

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THE DEMONOLOGY OF POLLUTION *

My starting assumption is that the battle against pollution has ceased to be merely a professional concern of conservationists, biologists, sanitary engineers, and the like, and has become a "crusade." In the course of such transformation it has acquired what any crusade needs: villains and moral indignation. I propose in the next half hour to inquire into the degree of villainy as well as critically appraise the grounds for indignation.

My interest in undertaking such an analysis is not in detracting attention from the useful chorus of voices that are crying for improvement. Rather my concern is over the possibility that we may be striking out at or pursuing what we honestly believe to be the villain without having acquired the basic knowledge we need to identify him. Moreover, it is altogether likely that in the headlong pursuit, and with the excuse that we are engaged in a good cause, we will commit a great deal of unintended damage to values that we prize highly and have no intention of harming.

I feel certain that if we ran an opinion poll, population growth would emerge as the chief villain. The charge: recent rates of population growth are the root cause of environmental degradation. The conclusion: zero population growth, beginning if possible tomorrow. How good is the case?

My own studies convince me that while population growth weighs heavily on whatever else is wrong, it is at this time in this country not a major factor in most aspects of the environmental crisis. I am suggesting that if there were today only one hundred fifty million Americans we would be only marginally better off, and if there were two hundred fifty million, we would be only marginally worse off. Not in all respects, but in most. In the art

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* Presented at the Environmental Teach-In, Pittsburgh, April 3, 1970, by Hans H. Landsberg, Director, Resource Appraisal Program, Resources for the Future, 1755 Massachusetts Ave., N.W., Washington, D. C. 20036.

of governing ourselves, perhaps 50 million one way or the other could make a difference. But certainly in most matters associated with production and consumption we would face pretty much the same variety and magnitude of problems as we do now: our rivers would be equally polluted, our air equally saturated with noxious gases, our parks equally crowded, etc. For it is high per capita consumption based on high per capita income, combined with a sophisticated and powerful technology, that accounts for the major fácets of environmental pollution in the United States today. Behind technology and income, size and growth ofpopulation runs a poor third.

Let me use electric power generation--a favorite contemporary villain--to illustrate the point. Growth in power generation in the last 30 years has been caused to the extent of 90% by higher per capita consumption and of only 10% by population growth. Were we to consider no more than the 1940 level of electric power generation compatible with sound environment, we would not be able to tolerate a population higher than 20 million in the United States today, assuming current per capita consumption. Or, taking today's population for granted, we would have to slash per capita consumption by 90%--implying a reduction in residential use from 6,000 KWH per year to 600, not quite enough to light an average house or apartment. I would not deny that population growth is a more important variable in some other contexts. Though the pervasive effect of income is surprising. Even in food, for example, the rise of beef consumption in the past two decades would have been only 35%, or so, based on population growth alone. Instead it rose 120% because per capita use went up 75%, and now commercial feedlots are a new environmental problem. Current per capita consumption would be compatible with 1950 production conditions at a population of only 80 million.

I draw on these simple illustrations to show the complexity of the problem. Unaware of the operative factors in such situations, one would tend to concentrate on population as the villain of the piece and incline towards drastic measures to reduce fertility. In doing so we could easily perpetrate a great deal of harm in

the firm belief that we are serving the cause of environmental enhancement.

This does not mean that we should not for a variety of good reasons, including the contribution to preservation of the environment, endeavor to reduce the rate of population growth. Indeed, both individual families and society as a whole would benefit from such a reduction. Moreover, the factors that indirectly work toward reduced population growth are wholly desirable in themselves. Finally, while achievement of a net reproduction rate of unity, that is one in which mothers merely replace themselves, would throw up some serious social and economic problems, they would be far less upsetting than those caused by continuous population growth. But that is a far cry from tagging population growth as the root cause of present environmental problems. Analysis does not bear out such a finding. And some of the suggested cures are worse than the disease.

Both in the causation and the remedies, the issue is far more complex regarding technology, villain #2. To begin with, it is useful to think of technology-caused problems as a spectrum, extending from nuisances, inconveniences, and insults to our sense of aesthetics, all the way to potential threats to the life-supporting capacity of the earth. Similarly, the remedies range from relatively simple and cheap technological and institutional modifications to complex and exceedingly costly ones that involve wholesale revampings of our living modes.

However, here too, we would be ill-advised to be guided by moral indignation and use a club on the villain. What should give us pause, first of all, is that a given technology takes on "good" or "bad" characteristics according to the societal and historical context. The internal combustion engine is a good example. I believe that you will search the literature in vain for an indict-

of the internal combustion engine as a polluter of air until the late 'fifties or even the early 'sixties.

By contrast, preoccupation with the motor vehicle as a safety hazard, for example, goes back to its very beginnings. The 1968 Report of the Advisory Committee on Traffic Safety to the Secretary of HEW (which incidentally is as incisive a document as you can find when it comes to deflating preconceived notions) relates that "in 1895, for example, when there were only four gasoline-powered vehicles in the United States, two were in St. Louis, Missouri, and managed to collide with such impact as to injure both drivers, one seriously."

That this preoccupation did not produce effective control measures but that it was left to conventional wisdom (e.g. "it's the driver's fault") to cope with the growing menace is another matter. I am here only concerned with a more narrow phenomenon, i.e. the emergence of concern. And as for air pollution from motor vehicles, the reason why indictments have only cropped up recently is, of course, that until 10 or 15 years ago the motor vehicle population was below the level at which it could be identified as an important producer of pollutants. Its growth by some 35 million in the last decade appears to have overtaxed the capacity of the air over densely populated places to assimilate exhaust gases. Moreover, certain polluting effects are intimately associated with the heat produced by the engine. Thus the transition from the Model T to the souped-up 300-horsepower high-compression model of the contemporary scene contributed greatly to making motor vehicles the problem that they have now become.

But here again, careful analysis and a measure of distrust of what may seem the obvious, rather than condemnation by hindsight / as indicated. Firstly, air has a

very large capacity for harmlessly absorbing emissions of gases. Any demand for zero emissions or zero tolerance -- which easily turns into a demand for zero motor vehicles -- thus needlessly compounds a difficult situation. There is nothing wrong with utilizing the ambient air as an assimilator of waste, provided one knows the threshold of trouble and the cost of the cure -- which may be thought of as putting a charge on its use. Secondly, it is the combustion engine in its current form that creates the problem. With a moderate sacrifice in what is called "performance," but which more often than not is mainly a package that makes the motor vehicle a more dangerous instrument than it need be, it now seems that the polluting characteristics of the combustion engine can be effectively reduced. Any general lamentation that goes no further than "look where technology has got us" seems to me unconstructive, at best. Not only can technology be aimed in different directions and turn out to be highly useful in environmental matters; as I shall point out later, it can be supplemented by economic pressures (for instance, taxation rising steeply with horsepower as already utilized by insurance companies that use a horsepower/weight ratio to penalize the high performance cars as special-risk categories.)

Not all technologies are amenable to such relatively painless modification. Some, if pursued without check have the potential of undermining the very support of life. I shall return to these later, but simply comment here that our concern over some of the more profound, even if remote, threats is not really cause for indignation directed at technology; because again it would be hindsight. More appropriate, therefore, would be a powerful call for foresight, and in all likelihood that means new institutions charged with exercising foresight.

In any event, technology does not operate in a vacuum, and so another popular villain is "the system" which causes technology to be invented and applied. Sometimes it is the economic system that is indicted, sometimes the political structure, sometimes a vaguely conceived image called "modern man" as opposed to a gentler notion of man. In most instances it is probably a rather amorphous conglomerate of all these factors, since they are difficult to separate. For example, unless the producer who advertises environmentally harmful items is matched by a purchaser who is willing to be persuaded, no harmful consequences will emerge.

I find it easy to deal with some of these aspects, but hard to understand, let alone operate with others. First, the easiest one: our economic structure, characterized as a market system which uses costs, prices and profits as guides to resource allocation. My judgment here is that it is on the whole a serviceable arrangement in matters of production or consumption. That is, it is an efficient way of transforming wants or preferences that potential consumers have or are led to believe they have, into supplies to meet such wants at least cost.

Of course, the system as it operates is afflicted with defects; but slowly we have been inventing means of improving on it and, in any event, there is nothing in history or on the horizon that has worked as well in accomplishing the enormously complex job of allocating resources among myriads of possible and competing end-uses. Relative shifts in costs and prices and their effect on profits do just that. It is my guess -- and hope -- that we will improve the system further especially by giving it greater capacity for evening out income differences, at least at the extremes, since this is where the system

produces the least acceptable results, that are, moreover, in danger of being aggravated by policies designed to alleviate environmental degradation.

However, when it comes to disposing of waste, be these residuals of what has been produced and is consumed, or all manner of side-effects that are the result of human activities, we have no semiautomatic controls analogous to those that regulate production and consumption activities. Indeed, here the system often works in reverse. Striving for least cost, both producer and consumer tend to dispose of waste in ways that impose the greatest cost upon society. In short, the market economy works in a reasonably satisfactory way as an organizing principle for production and allocation of resources, in situations in which buyer and seller are well identified and in direct contact. It does not help us, and indeed sometimes hinders us, in organizing at least cost to society the handling of waste.

Until recently, however, this deficiency was of little significance. At the earlier, lower levels of income and technology the capacity of the environment to assimilate waste was quite adequate. Consequently, the environment could legitimately be treated as a "free good": subjecting its use to constraints, such as costs or standards, was not something that society found necessary or even desirable. Not only in market economies, but equally in societies that follow totally different economic philosophies. Environmental pollution is a problem in the Soviet Union for example, as well as in East European satellites where the profit motive is absent. In its place are the maximization of output, the meeting of quotas, and costing standards that, just as in a market economy, regard water, air, and other aspects of the environment as freely available elements of production.

Formulated generally, it seems to me that any organizing principle of production other than one that explicitly assigns a value to environmental

factors is bound to shift the maximum burden to these costless aids of production. Sooner or later, ignorance of interrelationships in natural systems and, therefore, neglect to set limits to such free use will result in environmental damage. Sooner, where incomes are high, later where incomes are low. To indict the economic system that happens to prevail is legitimate only in the sense that any system that allows unrestricted use of the environment will sooner or later find itself in trouble. By the same token, any economic system can be made to be responsive to environmental considerations, and that to me seems the real challenge. Favorable experience with sewer charges provides an encouraging example.

A brief comment on two specific features of our economic system: growth and inequality of income.

Economic growth, and its measurement -- GNP -- have of late fallen into disrepute, rooted in the realization that in fact it is high consumption based on high incomes that have caused most of our environmental problems. But economic growth need not, of course, consist of extras, frills, and planned obsolescence. It can, also, consist of public goods, including improved environmental quality. In a more meaningful sense, economic growth should stand for increased options for everybody. Therefore, it is in principle something to embrace. It means moving from spending 70% of the household budget on food, as in much of Asia, to spending less than 20%, as in this country. And it need not mean producing a clutter of private consumption goods the disposal of which occupies an increasing part of our efforts. I would want to take a close look at the consequences of stopping growth so defined before advocating it, and I would suggest that we do not waste time in attacking GNP which is a perfectly useful indicator of some of the economy's characteristics and not of others. It surely tells us nothing about "quality of life" or happiness, and it was never intended to do so. One reason is

that it does not register values in the economy that the economy does not buy and sell. If its meaning has been exaggerated in the past, let us just not do so in the future. But that is about all there is to GNP. Except this: it is a great deal easier to call for a halt to growth from the vantage point of the U.S. as compared to, say, India or Nigeria, or from the security of a $10- or $20,000 income per year than from one of $3- or $5,000.

Whether and to what extent inequality of income contributes to environmental degradation is obscure at this point. It is a subject with which researchers have not much bothered as yet. Nobody has asked, to my knowledge, whether we would be better off, environmentally, with everybody having a $5,000 income than with our current income structure. My own hunch, not based on any research that I have either done or seen, is that greater income equality would lead to a less damaging impact on the environment, partly because striving to emulate highly wasteful consumption patterns that prevail in the upper income levels would be absent, and partly because at the average income now prevailing certain types of consumption would perhaps be entirely absent or only moderately present. In that sense, our income structure might indeed be a contributor to environmental degradation.

In dealing with the effects of the economic system I have dealt implicitly with another villain, the modern corporation. Since it lives by the profit motive, it obviously will exploit any cost-cutting opportunity, and free use of the environment for private gain and social loss is one of these opportunities. But, one must ask, is it really unique to the private corporation? My answer would be in the negative, and for the same reason I have given above for the economy as a whole. The Soviet Steel Trust in no way behaves differently from U.S. Steel. In both instances, it takes the imposition of specific constraints on the producer to bring about consideration for the environment. Neither beast is by nature inclined to volunteer for extra duty.

In considering the role of the corporation -- as a shorthand expression for private business enterprise -- it is useful to realize, however, that the very characteristics which lead it to exploit the environment as a cost-cutting device can be harnessed to making it contribute to its improvement. The imposition of charges, for example, high enough to compensate for any damage caused -- not excluding levels that are tantamount to prohibition -- will stimulate a search for a technology that will help it reduce or totally escape from these charges; though care must be taken that such escapes are not elusive. Since air, water, and land pollution are alternative ways of managing waste disposal, charges must be so structured as not to turn the air polluter into a water polluter, or vice versa.

With this qualification, and it is an important one, there is no reason to believe that competition cannot become a help rather than an obstacle to environmental enhancement. That we have barely scratched the surface in the search for new policies does not mean that the potential is not large. The corporation, after all, has come to terms with industrial safety, with minimum wages, with the end of child labor, and with many other institutions that are not in its short-run interest but that society has managed to impose upon it. I see no reason why it cannot be made responsive to policies designed to protect the natural environment.

In summary then, I am contending that new circumstances call for new economic and social devices, and that these are available or can be invented. By putting a price on use of the environment the system can allocate resources in waste-handling similarly to the way it has been managing allocation of resources in production, as, for example, the currently pending Proxmire bill attempts to do. The real difficulty lies in translating concepts into a working system. Standards and charges must be set in such a way that the need for protecting the natural environment will be balanced with the need for providing depositories that can efficiently assimilate waste. These trade-off points are not easily located. Moreover, the most

economic use of the environment is often available not to a single user but to an aggregation of users, embracing often an entire region. Thus, ironically, a real but poorly known villain can at times be the well intentioned producer acting in isolation or, for that matter the well intentioned consumer. There are many situations in which none of them, acting singly, can accomplish as much as efficiently as they could in some collectively organized fashion. Here lies a fruitful field for government efforts in putting together appropriately-sized units of operation.

This takes me to the often-voiced charge that "the enemy is us." In some sense this is indisuptable. By changing the face of the Earth and by altering the structure of matter man is indeed the biggest causative agent. What disturbs me in this orgy of breastbeating are two elements. One is the common failure to balance pluses and minuses, frequently associated with a highly romanticized notion of how good everything used to be. In an interview published in the New York Times on March 22 Arthur Godfrey is cited as recalling "how beautiful this country was when we had 100 million people." A look at the Statistical Abstract reveals that the year was 1915. While I cannot give you a personal account of what else was true in 1915, there are some interesting statistics I can supply: the birth rate was about 30 per 1000 as compared with about 17 per 1000 now, and the crude death rate was over 13 as compared with about 9 at this point. Life expectancy was a little over 50 years, compared with over 70 years now. Unemployment ran above 8% in 1915, and those who had jobs worked nearly 50 hours a week. Per capita expenditures for pupils enrolled in public schools were $31.00 a year, or, adjusted for intervening price changes, something like one-sixth of what they are now. There was no social security, no medicare.

Obviously, I could go on with this catalogue. The only point I wish to make is that while the country was certainly emptier, and I am sure, in many

places more appealing to the sense of the aesthetic, we have since then modified life in a large number of positive ways that must be considered in any assessment of the total impression. Much has been lost, and much has been gained. The need to draw up a balance sheet, however difficult that may be, seems compelling.

The common approach to balancing good and evil seems to be to debit man with the instances where reason has served him poorly but not to credit him where reason has served him well. As a consequence he is pilloried as the great despoiler, the rotten egg. This strikes me not only as a far from satisfactory procedure, but also as singularly unhelpful in coming to grips with a most complex and potentially dangerous environmental situation. Surely, it would be preferable if each of us were more mindful of the broader consequences of our activities and especially of the impact on society as a whole, on the lives of those who will follow us, and on the natural environment. But I am not persuaded that, having tasted of what modern technology has to offer and what additional creature comforts extra effort can provide for the individual, we can so modify our attitudes as to solve the environmental problems we are facing. Moreover, in many situations it is neither obvious for the individual what behavior would best advance a societal interest nor in his power to advance it if he could identify it.

That is one reason why I can understand but not find constructive the now so fashionable self-flagellation. Another is that I can see it as a short-lived up-welling, a strong reaction to an awakening to a whole new set of distasteful problems, but I am concerned over the setting-in of saturation, of overkill, when there is no careful attention to priorities, to gravity and nearness of dangers, to appropriateness of remedies, and the like. My interest, therefore, is less in villains -- and least of all in THE villain -- than in attempts to build into our daily routines incentives toward socially desirable behavior, on the one hand, and toward capacity for watchfulness, on the other.

It is easier to give meaning to the first than the second half of the formula. We all know the problem created by the non-returnable container. I believe we realize equally that no amount of exhortation will convince the industry to change to a returnable one, nor the consumer to deposit the empties in ways that facilitate their collection and reuse. In both cases it is a matter of cost. The producer finds it cheaper to not be bothered by collection and reuse. The consumer finds it more convenient, cheaper, that is, in his own way, to dump the container whereever he has emptied its contents -- a street, a park, a lake.

In this kind of situation our economic incentive system works in a perverse way, both because we do not put a price on access to the environment and because different parts of the economy have developed at different rates and are out of whack. Wages and costs of services generally have risen in relation to the cost of natural resources, sufficiently so as to render scavenging, collecting, and transportation uneconomical. At the same time, no cost inhibition keeps the individual from dumping the container in the landscape; there is no market in which such dumping rights are bought or sold. Yet, there is a clear cost to society, partly psychic, partly monetary. What is more logical in this situation than to modify the incentives? Attach, that is, a cost to the dumping. It will (a) keep the consumer from engaging in it, (b) make it worth somebody's effort to collect those containers that are nonetheless dumped, and (c) by facilitating the gathering reduce the cost of reuse sufficiently to make it competitive with new material. It would even pay society to subsidize the operation, if that should become necessary to close the cycle.

Here, it seems to me, is a clear example of how our economic system can be turned to advantage and made to yield a most desirable result, that does not depend on appeals or commands, except that there must be an initial

regulatory, or if you wish political, push. Here is a fruitful field for pressure on legislators, and I would think that efforts such as a teach-in can generate the momentum to accomplish the needed change. Neither new technology nor a moral remaking of the nation are called for. Merely the intelligent use of economic incentives.

The same kind of approach is applicable to other solid waste problems that have come to plague us. Perhaps a modification of ownership characteristics will give us something like a "returnable automobile," returnable not for constant repairs as now, but returnable in the sense that a residual of ownership remains with the producer in such a way that he must accept responsibility for the vehicle when it has become unserviceable. In that event, he would likely design a vehicle for easiest and greatest re-use of its parts, as such or as scrap. In addition, he would have an incentive to facilitate collection. Barring other cost-reducing innovations, this could and probably would raise the cost of automobiles, but anyone who believes that environmental improvement can be had without cost engages in wishful thinking. We have two options: either to pay the cost in terms of degradation of our environment, that is, putting up with the penalties ranging from inconvenience, nuisance, and insults to our sense of aesthetics all the way to endangering the survival of the species; or to make these costs explicit, that is, reorder our consumption patterns by buying less and paying more for conventional goods to cover what it costs to protect the environment. I see no third option, no matter under what economic system we live. In this perspective, the automobile changes from something to be extinguished to merely a convenience to be managed in novel ways compatible with preserving our environment.

A highly welcome byproduct of thus promoting recycling would be a corres-

pondingly diminished draft on our natural resources. Not that I think that we are in any danger of what is called "running out" of resources. This is a big subject which I shall not at this time tackle. But even if we are not running out, recycling recommends itself / on many grounds: as a matter of prudence, as reassurance for the countries that are only beginning to be materials consumers on a significant scale, and as a way out of rising disposal problems. For the best disposal policy is not to generate anything to be disposed of, but to close the production-consumption cycle without a leak to the environment. This is not, of course, possible for some materials such as fuels, and it is also well to remember that recycling itself commonly requires energy. The problems posed by disposal of waste heat, by emission of carbon dioxide to the atmosphere with its long-run potential for climatic change, and by disposal of nuclear fission products are perhaps among the most serious environmental issues of the future. In view of the gravity of the interactions, and the possibility that avoiding them may call for major modifications in our patterns of production and consumption, it is fortunate that most of these problems seem to have a sufficiently long time horizon to allow us to mount a vastly increased research effort, which we urgently need if we want to approach them without panic.

But for most solids, reuse must be the goal, and new institutions or incentives can get us a long way toward that goal, though not all the way, because there are areas in which we will require more drastic measures. Just as we do not rely on the high cost of repair services to keep drivers from behaving in ways to provoke accidents, so we shall discover situations in which the restraint that derives from attaching a price tag is not enough. The use of certain pesticides is a good current example. Though our knowledge is as yet incomplete, prudence demands that, with exceptions dictated by special circumstances -- malaria control comes to mind--, we prohibit the use of DDT rather than rely

on a tax to restrain its use, or, if one wishes to see it that way, set the price at infinity. There may--and probably will be--similar instances that call for flat prohibitions. But these should be only a last and rarely used resort. In most instances, intelligent use of regulation and incentive-penalty systems will do the trick in a manner most compatible with individual freedom. To many frustrated by the stubborness of environmental problems this might seem a meek prescription. I disagree. I think it will take real political strength to bring about the necessary changes. Those who see them as the most rational path toward a better environment owe a vote of thanks to people like you who will provide the political climate in which such changes can and will be engineered. Indignation and rational analysis make a good pair. I hope they can exist side by side, the first to provide momentum, the second to help us understand that the hot pursuit of no single villain can result in acceptable solutions, as I have attempted to demonstrate.

Let me close with a caution: beware of any solution offered that is easy, cheap, and instantaneous. On closer inspection it will turn out to have disregarded some major implications, consideration of which will show it to be difficult or costly or slow, or all of it. Take a leaf from the ecologist who insists on the interrelatedness of the components that make up an ecosystem. I believe you will find that one of the most complicated ecosystems is a modern industrialized society. The prescription on the medicine bottle should therefore always bear the admonition "use well before shaking."